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characters; others are to be found in size, in odor, perhaps also the natural doubling of flowers might be recognized in this manner, as this involves a mere transformation of parts and no essential structural differences, although here we are running pretty close to morphological characters; I am not sure, however, that it would be best to rigidly exclude certain of these. The difficulty will be to limit the use of the term to some definite set or sets of characters. If we enforce merely relative permanency we shall all have different views as to what this implies.

The whole subject of the limitation of the various ranks in classification is one which botanists will do well to consider and the pages of the BULLETIN will be open to communications on the topic. By the presentation of different views we might be enabled to reach some valuable conclusions to guide us in subsequent work. The difficulty in restricting the use of "form" is met with in variety, in species, in genus, and, indeed, in every term of our system. Let us have a discussion of the matter, if for nothing else, in order to ascertain just what thoughts are in the minds of botanists of the present generation, for all must have thought more or less about it. Then those of us who meet in Indianapolis will be in a position to talk it over in all its aspects.

I can hardly agree with Mr. Cockerell in the (implied) advisability of changing a published name, however, if a supposed species or variety was to be reduced to a form, for I presume that the trouble that this would give the future student would outweigh the slight advantage of a descriptive adjective; so I should be for forma *Jonesii* of his supposed white harebell if it had been published as *Campanula Jonesii* or *C. rotundifolia*, var. *Jonesii*, for in the future it would make no difference either to Jones or himself, and he would not disturb nomenclature by introducing another adjective, *albiflorus*.

N. L. BRITTON.

The Mandioca.

BY THOMAS MORONG.

In an economic point of view the Mandioca or Manioc is one of the most important agricultural productions both of Brazil and Paraguay. It takes the place of wheat in the northern conti-

ment, furnishing the inhabitants with an abundant, cheap and nutritious breadstuff, yielding an enormous quantity of material all the year round. With this the people are independent of the rest of the world for food. Here in Paraguay I do not know how they could get along without it. Corn, or maize, as it is generally called, is indeed raised, but it is a somewhat uncertain crop, and needs more cultivation than the native Paraguayans are disposed to give to anything which requires care. Their chief article of subsistence, therefore, is this wholesome and easily raised root, which the laziest people on earth can have with scarcely any labor.

As found here, the Mandioca is of two forms or species, each of which has several varieties. One of these, which has borne various botanical names, such as *Manihot Aipé*, *Manihot palmata*, *Janiplia Loefflingii* and *Jatropha dulcis*, but called by the Paraguayans "*Mandioca dulce*," is the most common. The other, known to the natives as "*Mandioca brava*" (*Manihot utilissima* of botanists), is not so frequently cultivated, though it is often seen in the fields. The sweet Mandioca forms the principal article of diet of the common people, as its roots are entirely innocuous. They may be used as a vegetable for the table, equaling the potato or the parsnip, which they much resemble. Boiled for table use they are white, sweet and palatable. All foreigners take to them at once. They may be fed to animals in the raw state, and are greedily eaten by cattle without injury. They are full of starch; indeed, that is the ingredient which renders the Mandioca so valuable, and the roots are frequently used as is the potato in our own country, for the manufacture of this important commercial and domestic necessity. The roots are grated or ground into powder, and, after the juice is expressed, dried in the sun or on plates over a fire, and thus made into flour, which forms an excellent bread when baked. The Paraguayan method is to knead the bread with new cheese or ground rice, melted fat, salt, water and a little coriander seed, prepare it in long cylindrical rolls or rings, and bake it in the rounded earthen or brick ovens, resembling huge ant hills, which may be seen in the rear of many of the houses. The bread thus prepared is commonly called "chipa." The chipa bread, if I may be allowed to express an opinion, is, at least when fresh, a delicious article

of food. The native women make and sell great quantities of it in the Asuncion market. In the town of Luque, on the Asuncion and Villa Rica Railroad, they are noted for the fine bread which is made of this flour, and the passengers eagerly purchase it from the women who offer it for sale. I have also seen pastry and sponge cake made of the flour as light and palatable as anything prepared from wheat flour, and I do not know why it may not serve all the purposes for which the latter is used.

If the ground powder is heated upon iron plates and partially cooked, it clusters into hard and irregular lumps, and forms the well-known tapioca of commerce, or prepared somewhat differently it becomes the article known in England as "Brazilian arrow-root."

The *Mandioca brava* does not differ much from the *M. dulce* in external botanical characters. Both are stout herbs, growing from five to eight feet high, branching and very foliaceous. Both have their flowers in short axillary racemes, the flowers small, purplish-white and nodding, producing a capsular, 5-valved fruit, and an acrid, milky juice. The leaves of both species are alternate, on long petioles, palmate, with narrow, deeply cut lobes. The natives, however, readily distinguish the two species. *M. dulce*, they say when questioned, has red stems, petioles and leaves, while those of *M. brava* are white. On examination, however, it will be found that this distinction will not always hold good, as *M. dulce* frequently has stems and petioles almost or quite white, while those of *M. brava* are not unfrequently reddish. A much better distinction lies in the shape of the stems, which in the former case are nearly or quite terete, while in *M. brava* they are more or less angled; and also in the angle at which the petioles of the two species spring from the stems, rising in *M. dulce* at a right angle, or even sloping downwards, and in *M. brava* at an angle of sixty or forty-five degrees. After all, the only satisfactory distinction lies in the juices of the two plants. That of *M. dulce*, as already stated, is sweet and innocuous. That of *M. brava*, on the contrary, is *poisonous*. The juice of this species has been known to kill cattle if the roots are eaten in the raw state. If, however, the juice is thoroughly squeezed out, and the grated pulp dried, it may be used in mak-

ing flour and bread, like that of the other species. Indeed, some of the people here tell me that they prefer the bread made from *M. brava* to that made from *M. dulce*. It makes a lighter bread they say, but I cannot see much difference between them. In Brazil, I believe, the *M. utilisima* is most commonly used in making cassava bread and tapioca, but either species will produce the same result, and certainly *M. dulce* is much the safer of the two. Why two species so closely resembling each other in all external botanical characteristics, growing side by side in the same soil and under the same conditions, should develop such different active principles, is one of the vegetable mysteries which cannot be solved, but that they do is certain. I do not find that the roots of the *M. brava* are ever exposed for sale in the market, though those of *M. dulce* may always be seen in great piles upon the floors and benches of the market-house. The people evidently have a wholesome dread of the poisonous species.

The *Mandioca* is very prolific. It is grown from slips, and never from seed, so far as I have observed. All one has to do in order to get a field of it is to cut the stem into layers, as is done with sugar-cane, and stick the joints into the ground, where it readily sprouts. I am told that one plant will continue to send out roots for nine or ten years in succession, and even propagate itself in this manner, if not cut off. The roots, which are the only part of the plant used, are from one to two inches thick, and run just beneath the surface of the ground for two or three feet. They have a brownish coat, and a granular, white interior. For table use they are generally taken when about nine or ten inches long, or else broken up into pieces of this length.

I hope to see this valuable garden plant introduced into the United States. I do not see why it may not be easily raised in our Southern States, where the temperature is similar to that of Paraguay. So far as I have observed, the *Mandioca* (or Cassava, as some persons choose to call it) prefers a light or sandy soil, and a temperature such as the Palmetto or the Orange requires. It is true that Paraguay has a very humid climate, and possibly the *Mandioca* might not at first thrive in a dry region, but that is a question that can be settled only upon trial. I am quite certain that if it were once known in our country, and all its valuable

properties made apparent to the people by successful cultivation and use, it would be esteemed there as here. If it became in the Southern States as common as it is here, it would at once render the common people independent of the Northwestern wheat fields, and furnish them with the cheapest means of living which they have ever known.

Possibly the experiment of raising this root has already been tried in our country. I am ignorant upon that point. But I can see no reason in soil or temperature why it might not be easily cultivated in Florida, Georgia, Alabama, Louisiana and Texas.

ASUNCION, PARAGUAY, July, 1889.

[See an article on this subject by Mr. H. W. Wiley in "Agricultural Science," ii. 256-260 (1880).—ED.]

Botanical Notes.

Note on Harfordia, Greene and Parry. The criticism contained in Botanical Notes, Proc. Cal. Acad. 2d series, i. 235, 236, ostensibly directed against the proposed separation of the genus *Harfordia*, Greene and Parry, from *Pterostegia*, F. and M., may be most satisfactorily answered by quoting the written opinion of the late Prof. Asa Gray in letters addressed to the writer, viz.: In letter of July 12, 1886, before receiving specimens: "As to *Harfordia* no doubt (without examination as to particulars) it is a good genus." In letter of July 19th, after receiving specimens: "I looked at the specimens sent and I should certainly have made a genus of it if it came in my way, *prima facie*. The separation of the sexes, and no involucre to the male, and shrubby stem, should indicate separation." C. C. PARRY.

Utricularia resupinata, B. D. Greene. In a recent examination of the Florida collections of the late Dr. A. P. Garber, I find this species under the name of "*Utricularia purpurea?* Walt.?" accompanied by the following note: "Grows on low, open, flat ground, which is dry until the wet season (June) and then is covered with water and becomes a pond; flowers very fugacious; plant 1 to 2 inches high." The station at which it was obtained is Manatee, and the date of collection April, 1876. Its occurrence so far south, and on the western coast of Florida, is certainly remarkable.

THOS. C. PORTER.